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Empirical Study of Key Success Factors in IS Projects

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Abstract: *Inter-functional business integration that improves cooperation among departments, or even inter-organizational integration could be supported by the implantation of an ERP system. Consequently, in these last five years, more and more companies are implementing ERP system but lots of them fail so far. We try to understand in our work, from a project management perspective, the reasons that bring the ERP implementation project to success or to fail. We provide in this article a brief overview of the literature dealing with key success factors related to an ERP implementation project to better cope with the field, then we study the case of an ERP implementation project in a company operating in automotive industry, with a quail-metric methodology, to better deepen the reasons of ERP implementation projects success or failure.*

Keywords: *ERP Implementation Project, Key Success Factors, Case Study, Quail-metric Approach.*

1 Introduction

Over the last two decades, due to the environment changes which are more and more complex and uncertain, all companies are brought to organize themselves, especially the industrial ones because of the intensity of material, financial as well as informational flows in a way to take into account the maximum variables in order to make optimal decisions. This requires updated information which can be provided only by resorting to communication technologies and information systems.

In order to reduce uncertainty and improve the flow of information within business, it's necessary to integrate all organization entities by interconnecting all information systems around a centralized database. Companies used to develop these kinds of information technology systems in-house, but now, they radically change their strategies by turning to buy off-the-shelf software.

One of the most adopted software by most industrial companies these days is the Enterprise Resource Planning system (ERP); this packaged application software has emerged in the last two decades, and became very popular in companies. Moreover, Deloitte and Touche states that businesses prefer to replace their legacy system with enterprise resource planning system (Christopher and Ben Light, 1999). This transactional system can be defined by Moon (2007,p.235) as “ an enterprise information system designed to integrate and optimize process and transactions in the company”. So, the ERP system consists in managing well the flow of information and, consequently, automatically streamlining the internal and external resources by interconnecting several management information systems, which promotes cooperation between different stakeholders in a company.

However, before taking the highest benefits of ERP system, its implementation within an organization requires a planned and organized process, which is usually called “project management”; this concept presents a structured approach that aims generally to manage the conception, the selection of the software, and its implementation within budget and on time.

The ERP system can effectively reap enormous benefits for successful companies, or it can bring organizations to disaster if they fail to manage the implementation process, and the issue to which we try to answer through this contribution is: what are the key success factors that all stakeholders should take into account in order to successfully implement an ERP system in automotive industry?

2 Information System Project Management: a Comprehensive Approach

The necessity of facing an increasing complexity for realizing a consistency between organization systems and the need of handling organizational inefficiencies have brought all organizations to use projects as a crucial factor that plays a pivotal role in their growth by translating strategies into actions and objectives into realities with higher success rate and lower costs.

Lowery (1994, P3) defines a project as “a set of activities related to a particular period of time that end by a specific accomplishment. It emerges when there’s something not ordinary to fulfill”. Also, in 2003, the standard ISO 10006 stipulates that this strategic tool is "a unique process that consist of a set of coordinated and controlled activities, undertaken in order to achieve an objective in accordance with specific conditions such as time, costs and resources constraints "(Morley, 2006, p.8). Finally, Thullier and Diallo (2005, p.197) see the project as "a complex and temporary organizational system that produces goods or services contributing to satisfy a goal on time, within budget and with respecting its specifications".

In order to have a clear idea about projects, this contribution come up with a comprehensive definition considering that a project has a dynamic or a temporary organization incorporating a set of objective, interdependent and specific activities, constrained by material, human, financial and time resources, undertaken by individuals with different skills, in the sense of a common and oriented goal, and a predetermined deadline.

From definitions pointed out in the previous point, managing a project means planning, organizing, leading and controlling its implementation by taking into account its different characteristics. However, Morley (2006) suggests another view of project management by considering that once the project is characterized by three main conditions, namely, objectives, timelines and resources, its management could be assigned to three main tasks: time management, resource management and production management.

Time management aims to determine the project temporal extent and to distinguish its different steps by identifying its milestones in a specific calendar. Resource management is particularly based, for a first time, on managing a financial envelope, namely a fixed budget. The division of this budget according to needs enables the acquisition of material and human resources as well as services, such as machines, materials, premises, technicians, engineers and managers, transportation, etc. Finally, the production management deals with managing different activities by interacting different resources within a determined time.

According to Lewis (2006, p.4), project management is *"the application of knowledge, competences, tools and techniques in project activities in order to fulfill assigned requirements. This fulfilment is attained through the application and the integration of initiation, planning, implementation, monitoring, control and closure processes of the project."* Also, for the Project Management Institute, project management is seen as "the art of leading and coordinating human and material resources throughout the project life using modern management techniques to achieve predetermined objectives in terms of scope, cost, time, quality and participant satisfaction".

In this context, it is known that a project can succeed, as it can, of course, fail. To ensure its success, project managers are required to have in mind a number of faults to avoid its causes. Lock (2007) points out some causes such as: a wrong definition and misunderstanding of the real extent of the project is one of the main causes that can drive the project to an imperfection. moreover, causes

may include a lack of precision of required techniques, a very optimistic estimation of costs, schedules and benefits, an incomplete assessment of risks, an inappropriate strategy, an inadequate estimation of cash flows and provisions, negligence of partners and stakeholders interests, a reduced attention towards motivations and incentives for employees being in charge of completing the project, a lack of broader view on behaviours with regard to change projects, and finally, a subjectivity in decision making concerning commitment in the project. In other words, other factors are taken into account such as political, personal and intuitive reasons instead of a business plan objectively established.

Finally, it's useful to distinguish project management from management by project. In this sense, Boutinet (1993) stipulates that project management focuses strongly on the concept of "the project" as a subject of management; it means that the project is almost the centre of the management issue, while management by project provides a management approach using a methodology mainly oriented project. In simpler way, "*project*" in the "project management" is an object, while in the "management by project", it presents a methodology. Thus, we can say that the management by project use project management as a management approach.

Having describing the project management, the next point consists in defining an information system project, which is the object of our contribution. An information system project is like any other project. However, there are some characteristics related to the specificity of information systems and to developments that have emerged in this filed. Few years ago, information system projects focused mainly on software and solutions development by the IT team of the company or by computer engineering services companies.

Today, this kind of projects has evolved to other alternatives like an off-the-shelf system implementation, information system urbanization, legacy system updating and preconceived solution parameter, etc. moreover, the relationship between the information technology teams usually characterized by managing the information systems or the computer engineering services companies on one side, and managers and users at the company on the other side has more and more strengthened, and this to ensure the alignment between the strategy and the structure of the information system and those of the company. In simpler words, the strategic and organizational dimensions of information systems are very important.

The information system project management presents a process with several steps, going from pre-analysis step, passing by the overall design and development steps, and reaching finally the implementation step. In this paper, we will focus on the implementation step, and this for various reasons. The first reason is that the first three steps include technical part that will not be studied in our research. The second one is that the implementation step presents generally a problematic by the fact that it confronts the software to the organizational realities not being always evident. The third reason, which is very important, is that ERP systems, around which is turning our contribution, are generally developed by an external editor to the company. Either ERP system are made to measure (custom-made) or they're standardized (off-the-shelf), the organizational and managerial problematic of the company starts usually with choosing the right software, its implementation and getting a well-appropriation in the organisation and, afterwards, how to use it optimally.

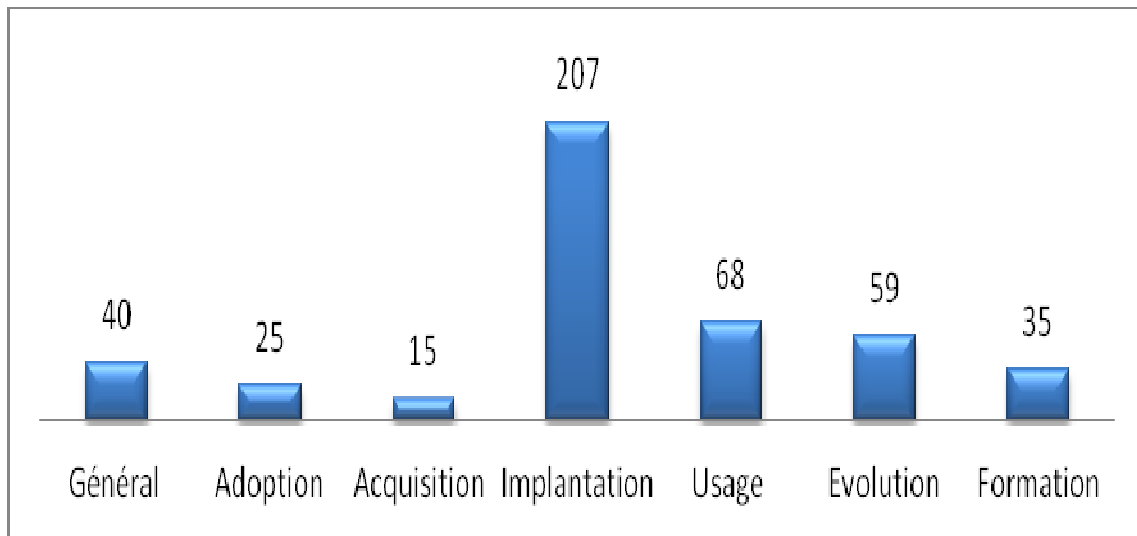
Several strategies can be adopted for the implementation of an ERP. Two strategies are usually opposed to each other. The first strategy is more ambitious and consists in implementing the whole ERP system in a single effort (big-bang); this strategy needs less time but more resources (material, human, financial, etc.), and it's relatively risky. The second is the gradual implementation strategy, which is less risky and less expensive but takes much time, and requires persistence and adaptation more elongated over time.

In this paper, we will not tackle the way of choosing an ERP system, we will rather discuss the different steps of ERP implementation after the choice of the partner has been made and contracts concerning the functioning rules were negotiated and fixed. Our ultimate goal is to analyze the factors which may impede the successful implementation of the software in question.

3 Key Success Factors in ERP Implementation Project

Implementing successfully ERP system is generally based on an appropriate implementation strategy, and the respect of planned and organized process as well as the acknowledgement of a set of objective factors that contribute greatly to the project success. These factors ought to be identified and assimilated in the whole project management process, and this, by all project stakeholders, especially by the ERP project team. The identification of these key success factors has been the subject of several studies, joining interests of researchers and professionals (cf. Gargeya and Brady, 2005). This growing attention to this issue was supported by the literature review of Esteves and Bohórquez (2007) (see Figure1).

Figure 1: number of publications per category



Source : Esteves and Bohórquez (2007, p.60)

The aim of studies related to ERP implementation success factors is to highlight the reasons allowing the company to achieve a high level of success, to save more time, to reduce costs, and especially to improve the quality and the effectiveness of its system (Finney and Corbett, 2007).

Indeed, these factors turned into a widely discussed topic, both in practice and research works. However, some contributions, such as those of Moon (2007) have a very broad view of the field by dealing with nearly all issues related to ERP systems, including Key Success Factors. Also, Finney and Corbett (2007) provided an important overview of the existing literature covering the KSFs of ERP implementation, by making a compilation, and identifying promising avenues for future research in the field. Esteves and Bohórquez (2007) have updated their previous work (Esteves and Pastor, 2001) by adding an annotated bibliography and applying content analysis on all recent works dealing with ERP system. Additionally, Kansal (2007) provides an important exploratory study on KSFs, revealing that they have largely been considered in the literature, but they have not much been classified. As a result, he made a list of the most important factors by classifying them according to their importance. Subsequently, he has assessed them in an empirical study in the electrical products industry. Indeed, Al-Fawaz et al. (2010) put in the fact that lots of efforts have been made to identify KSFs but they have not been categorized.

Kansal (2007) provides a list of thirteen KSFs: 1. Top management support. 2. Users' initial and continuous training. 3. Business Process Reengineering (BPR) and software customization. 4.

Project team competences. 5. Project Management. 6. Organizational Communication. 7. Clear goals and objectives. 8. Change Management. 9. Role of project leader. 10. Providers Support. 11. Users' Participation and involvement. 12. Use of external consultants. 13. Compatibility between technology and business need. Knowing that, all of these factors are correlated and interdependent (Ehie and Madsen, 2005).

For top management support, indeed, several authors stipulate that this strategic factor contributes largely to successfully implement an ERP system (cf. Somers and Nelson, 2004). This factor ensures two advantages, the first is the disposition of some leadership, and the second is the access to the available resources (Zhang et al., 2005). Also, the project team competences should be multidisciplinary by covering technical, managerial and social field. The fifth factor is adopting a project management approach that allows to focus always on results and to be constantly in conformity with programs and budgets (Gargeya and Brady, 2005).

Users' training is also very important and allows stakeholders to perfect their knowledge in order to get the ERP implementation project right. According to Al-Mudimigh et al. (2001), the ERP is an extremely complex system that requires rigorous training. The BPR and the ERP software customization contributes greatly to the success of the implementation project. So, more the company adapts its business processes and makes them in accordance with the ERP system, more the ERP system is customized, at least, in a minimum.

Organizational communication is a very important tactical factor. For Schwalbe (2000), the communication facilitates and accelerates greatly the work within an IS project by sharing information regularly among the project team members. The seventh factor is the clarity of goals and objectives. This allows all stakeholders to know exactly their goals against which performances will be assessed. Other KSF is managing the change that highlights a whole of technical and technological as well as organizational and managerial, but also social elements influenced by the ERP implementation in order to face any potential resistance from stakeholders and ensure good circumstances. The eighth factor is the role of project leader. In order to have an efficient role, the leader should be a high-level executive partner having authority to fix goals and lead change (Dawson and Owens, 2008).

Table1: Standish Group key success factors in the literature

| Key success factor | Characteristics | Authors |
|---|---|---|
| Users' involvement | Identify future users of the ERP, involve them in the project as soon as possible, develop channels of communication in order to ensure a permanent exchange with the project team and adapt the ERP system depending on their needs. | Kansal (2007), Dagher and Kuzic (2011). |
| Top management support | Identify key leaders in the company, who are able to mostly support the ERP implementation project and motivate and convince them by providing a detailed plan about the project so that they can make decision. | Yusuf et al., (2004), Kansal (2007), Finney and Corbet (2007). |
| Clear definition of needs | Lead functional and cross-functional needs analysis and risks and assessment. Elaborate a return on investment plan and define metrics, measures and milestones that determine success. | Soja and Paliwoda-Pękosz (2009). |
| Adequate planning | Prepare a synthetic document describing the project issues and benefits, with expectations and possible solutions. Select the right people and assign to each one a proper role. Planning must allow changes and adjustments. | Mandal and Gunasekaran (2003), Somers and Nelson (2004), Finney and Corbet (2007) |
| Realistic expectations | Prepare a document describing a realistic project, containing necessary arguments to demonstrate its practicality. Systematically eliminate unrealistic initiatives. | Esteves (2009), Ganesh and Mehta (2010). |
| Division into steps | Devising the project into several steps has a significant importance. Start addressing broad issues and, then, discussing progressively the details of each one. | Chen et al. (2009). |
| Project team competency | Settle on clearly required skills. Develop structured and oriented training for project team by both internal staff and external professionals. | Stratman and Roth (2002), Kansal (2007), Finney and Corbet (2007). |
| Project appropriation | Clearly define roles and responsibilities of all stakeholders of the project. Determine the organizational structure that allows coordinating all members. Link specific rewards to project outcomes. | Newell et al. (2004). |
| Clear visions and objectives | Formally clarify short, medium and long term vision, goals and objectives. Ensure the fit between predetermined objectives, strategy and overall goals of the company. | Mandal and Gunasekaran (2003), Kansal (2007). |
| Motivation and focus of the project team | Motivate the team by a set of means, such as premiums, bonuses, promotions, etc. Create a culture of ownership and collective work that creates a homogeneous atmosphere. | Barker and Frolick (2003), Finney and Corbet (2007). |

The support of ERP provider ensures a better understanding and a better integration as well as a guarantee of maintenance and monitoring of its ERP system. This factor is also most important in cases where business processes contain a variety of procedures and the existing legacy systems are very complex with multiple technology platforms. Also, users' involvement is very critical factor. And it's strongly useful to involve and engage users in the implementation project in order to converge to the ERP configuration with their needs by integrating the necessary processes allowing them to fulfill their missions. External consultants that have deep knowledge and long experience related to ERP system can help strongly the company face critical situations that require some level of analysis and expertise related IT system.

A final KSF is the compatibility between technology, which is ERP system, and business needs. Undoubtedly, more the ERP system is conforming to the reality of the company's business and its environment, more its implementation is easy to realize. Finally, it should be noted that all these factors are synthesized in the work of Kansal (2007) and they are relatively exhaustive. However, other factors can be highlighted, and this according to the characteristics of the company, its environment, the ERP editors market, or others. Moreover, the importance attributed to each factor varies from one company to another and from one situation to another.

We have adopted in our work the Standish Group KSFs for practical and effective concerns (see Table1). As reported by Gemino et al. (2008), and based on Hartmann (2006), Standish Group covered twelve years of data collection with over 50 000 accomplished IT projects. The Standish Group has provided a list of ten essential factors that the company should take into account in order to maximize the success of its software implementation. Even if the model was severely criticized by some authors, like Eveleens and Verhoef (2010), but we just mention arguments of Highsmith (2009) who stipulates that surely the Standish group data are not good indicators of poor software development performance. But, they represent indicators of systemic failure of planning and measurement processes.

4 Empirical Study

The methodology used case study is based on a quail-metric approach Savall and Zardet (2004), an intermediate approach between qualitative and quantitative field. First, open but oriented exploratory interviews were conducted within different departments of "SCOM Company"¹, a company operating in automotive industry, specialized in trucks and buses assembling and commercialization.

¹ This is not the real name of the company. For confidentiality concerns, we give it the name of SCOME Company.

The purpose of these interviews is the exploration of the existing system of SCOM Company, but also the assessment of the nature and the extent of problems that the company will possibly encounter during the implementation process of the ERP system. Subsequently, 14 Directors of several departments and divisions were questioned, including head office, production department, purchasing and supply department, financial department, IT department, Scheduling department, Methods department, Accounting department, Financial department, Maintenance department of production units, as well as other departments and services. The questions were adopted from Standish Group model, and subsequently customized according to SCOM Company specification.

The questions were categorized in ten groups characterizing ten major variables (key success factors), namely users' involvement (UI), Top Management Support (TMS), Clear Definition of Needs (CDN), Development of Correct Plan (DCP), Realistic Expectations (RE), Division of Project into Small Steps (DPSS), a Competent Project Team (CPT), Ownership of project by the stakeholders (OPS), Clear vision on project objectives (CVPO) and Productivity and Motivation of the project team (PMPT), with five items for each variable. Afterward, a Likert scale has been applied in order to qualify and have more precise answers.

The research results consist in analyzing the studied phenomenon from the stakeholders' answers in order to determine the risk factors that we should be avoided in order to reduce their impact on the project success. According to existing system, employees do not all use it when performing their tasks. Some of them don't use it at all. Others use the system just for communication (e-mail) or for calculation and planning, while few of them use it largely in their work. Thus, this fact brings us to say that technological culture is somewhat ubiquitous in the company. Also, the use of IT presents more and more a concentric phenomenon in some entities. SCOM Company had and still has several information systems. Some of them have been implemented by an external editor, while others were developed internally. The most important system that has been used until the early 2000s is the MM/3000 (Materials Management/3000) provided by HP. this software has a number of modules related to materials management, such as requirements planning, production scheduling, etc. However, all existing systems are not interconnected. So, adopting an ERP system that integrates all functions and divisions was a real need as it was affirmed by scheduling methods department manager who said: "actually, the implementation of an ERP system is not a choice but a necessity". From this, SCOM Company's goal is to implement an ERP system that will ensure the integration at least among the most important functions. As the ERP project has started in recent years, SCOM Company is now in the step of effective ERP system implementation.

We evaluate the progress of the ERP implementation during the project, knowing that the SCOM Company wishes to renew its computer equipments as well, which are relatively obsolete. Globally, the Standish Group method shows that the risk rate is 52.75%, with a standard deviation of 15.56% which is significant in terms of dispersion. For some, the risk related to the project can reach 80%, while for others it can border 25%. However, it's quite clear that most respondents found the project risky while only two (2) respondents don't.

Results analysis show that three variables, which are the OPS, PMPT and CDN, present mainly a high risk. And that explains the fact that roles are not clearly defined, that actors don't know precisely their roles and responsibilities, and that incentives and rewards do not greatly contribute to achieve defined targets. Productivity and Motivation Project Team (PMPT) present also a risk element; and also other variables that present fairly large risk, namely UI, CVPO as well as CPT.

Results analysis put in plain words that some entities have not been involved in the ERP project. This means that some future users are not identified by ERP project managers because they didn't participate in the process of the definition of their needs. Consequently, they are not in accordance with ERP specifications, and this adaptation could extend over time and budget. Also, ERP project objectives in terms of definition of expected features and measures tools to assess the evolution of ERP project are not clearly defined. This can expose the company to the fact that it can't define problems that can likely encounter during ERP project implementation. Moreover, SCOM Company doesn't mobilize all competences; however, several training seminars were programmed for some managers, but were not scheduled in convenience with all stakeholders. That reflects the difficulties of future users to understand the ERP software. Two other variables present a moderate risk, namely DPSS and DCP.

Finally, two variables don't present a significant risk according to respondents, and present relatively opportunities or key success factor for the ERP implementation project, these factors are TMS and RE. When deepening our analysis, we can say that some key leaders are relatively mobilized in the implementation project. For them, a successful ERP implementation is an important component for the survival and the sustainability of the company. However, failure is not acceptable at all. This may be due to the fact that there is no visibility on difficulties that faces project team, or there is no detailed project plan that can reduce the information asymmetry between managers and project team. However, incentives proposed by leaders to motivate the project team are not very interesting.

According to realistic expectations, the results show that SCOM Company has relatively realistic expectations about the project evolution. However, the specifications for these expectations are not sufficiently clear and quite formal as well as the priority of needs is not clear. Finally, no simulation has been performed so far, either because it is too early to make one, or because it is not planned.

5 Conclusion

Generally speaking a literature review reveals that the omnipresent nature of ERP system usually leads companies to come across complex organizational and technical difficulties that bring, in the most cases, the ERP project to fail. In order to get rid of them, researchers and practitioners came up with a considerable number of key success factors, such as those of Kensal (2007), that help greatly companies successfully implement an ERP system; these factors principally vary according to the nature and environment of the company. The Standish group provides a list of the most important KSFs. By assessing them within SCOM Company, We find that some factors present strengths because they are correctly perceived and assimilated by stakeholders while others present vice versa.

One of the main strengths is the willingness of a number of managers to succeed such a project, but also the competence of some actors who contribute to its implementation. However, this is not enough because it would require a broad involvement of future users, especially in the case of an ERP software which is a system involving a large number of staff. Also, the top management support should be perceived by those who are in charge of the implementation, but also by other members who likely contribute in one way or another to the success of the project. Also, it's very important to define clearly users' needs, to develop a correct plan, also, to have realistic expectations as well as a clear vision on project objectives. A competent project team formally could ensure greatly the appropriation of project. Finally, right incentives motivate largely the project team and improve its effectiveness and efficiency.

The hereby article reveals a considerable potential of further research that could focus, for example, on the examination of the applicability of the Standish group model to other companies in different industries, that brings us to second issue which aims to eventually generalize our case results. A third perspective research can revolve around an exploratory study about the status of the utilization ERP software in this kind of industry in order to improve their global performance. Longitudinal studies can also be conducted on firms in order to properly understand the dynamics of an information system project, namely an ERP implementation project. Comparative studies between compa-

nies may also be the subject of research by including contextual variables. Finally, the study of the measurement and valorization of the return on investment (ROI) of information system projects in general, and especially those of the ERP presents an important and strategic research field.

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